

What is claimed is:

1. A semiconductor laser device, which includes a multi-semiconductor material layered mesa structure having a laser resonance layer on a substrate and cladding layers formed over and below the resonance layer, comprising:

5 rounded corners connected to the substrate, in a lower portion of the mesa structure;

a current injection ridge formed on an upper portion of the mesa structure and protruding from an upper surface of the mesa structure; and

10 a passivation layer formed on the mesa structure and having a contact hole exposing an upper surface of the current injection ridge.

2. The semiconductor laser device of claim 1, wherein the upper and the lower cladding layers are a p-GaN/AlGaN layer and an n-GaN/AlGaN layer, respectively.

3. The semiconductor laser device of claim 1, wherein the resonance layer includes:

a lower wave guide layer stacked on the lower cladding layer and having a greater refractive index than the lower cladding layer;

20 an active layer stacked on the lower wave guide layer that generates a laser beam; and

an upper wave guide layer stacked on the active layer.

4. The semiconductor laser device of claim 3, where the refractive indexes of the upper and the lower wave guide layers are less than the refractive index of the active layer and the upper and lower wave guide layers are GaN based group III-V compound semiconductor layers.

5. The semiconductor laser device of claim 3, wherein the active layer is a semiconductor layer made of a GaN based group III-V nitride compound expressed as $\text{In}_x\text{Al}_y\text{Ga}_{1-x-y}\text{N}$ where $0 \leq x \leq 1$, $0 \leq y \leq 1$, and $x+y \leq 1$.

6. The semiconductor laser device of claim 3, wherein the ridges are formed on the upper cladding layer, and a second compound semiconductor layer is formed on the current injection ridge.

5 7. The semiconductor laser device of claim 6, wherein the second compound semiconductor layer is a p-GaN based group III-V nitride semiconductor layer.

10 8. The semiconductor laser device of claim 3, wherein the substrate further includes an n-type electrode on the upper surface, and the substrate is a sapphire substrate having a gallium nitride (GaN) semiconductor material layer or a freestanding GaN substrate.

15 9. A semiconductor laser device, which includes a multi-semiconductor material layered mesa structure having a laser resonance layer on a substrate and cladding layers formed above and below the resonance layer, comprising:

rounded corners connected to the substrate, in a lower portion of the mesa structure;

20 a current injection ridge and force distribution ridges formed on an upper portion of the mesa structure and protruding from an upper surface of the mesa structure; and

a passivation layer formed on the mesa structure and having a contact hole exposing an upper surface of the current injection ridge.

25 10. The semiconductor laser device of claim 9, wherein the upper and the lower cladding layers are a p-GaN/AlGaIn layer and an n-GaN/AlGaIn layer, respectively.

30 11. The semiconductor laser device of claim 9, wherein the resonance layer includes:

a lower wave guide layer stacked on the lower cladding layer and having a greater refractive index than the lower cladding layer;

an active layer stacked on the lower wave guide layer that generates a laser beam; and

an upper wave guide layer stacked on the active layer.

12. The semiconductor laser device of claim 11, where the refractive indexes of the upper and the lower wave guide layers are less than the refractive index of the active layer and the upper and the lower wave guide layers are GaN based group III-V compound semiconductor layers.

13. The semiconductor laser device of claim 11, wherein the active layer is a semiconductor layer made of a GaN based group III-V nitride compound expressed as $\text{In}_x\text{Al}_y\text{Ga}_{1-x-y}\text{N}$ where $0 \leq x \leq 1$, $0 \leq y \leq 1$, and $x+y \leq 1$.

14. The semiconductor laser device of claim 11, wherein the ridges are formed on the upper cladding layer, and a second compound semiconductor layer is formed on the central ridge.

15. The semiconductor laser device of claim 14, wherein the second compound semiconductor layer is a p-GaN based group III-V nitride semiconductor layer.

16. The semiconductor laser device of claim 11, wherein the substrate further includes an n-type electrode on the upper surface, and the substrate is a sapphire substrate having a GaN semiconductor material layer or a freestanding GaN substrate.